ISOTOPIC ANALYSIS OF ORGANIC MATTER IN ULTRACARBONACEOUS ANTARCTIC MICROMETEORITES (UCAMMs).

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Introduction: The central regions of the Antarctic continent provide unique conditions to recover micrometeorites (MMs) with a minimal terrestrial alteration. In January 2014, we performed a 4th expedition at Dome C (75° S, 123° E) to collect MMs from ultra-clean snow at the vicinity of the CONCORDIA station. In such collections it is possible to identify ultra-carbonaceous Antarctic micrometeorites (UCAMMs) characterized by a high concentration of organic matter with extreme deuterium excesses [1, 2]. Organic matter vastly dominates some fragments while others exhibit a substantial mineral component. Infrared spectroscopy performed at the synchrotron SOLEIL (France) showed that UCAMMs contain nitrogen-rich organic matter and bulk atomic N/C ratios measured for two UCAMMs range from 0.05 to 0.12 [3]. While most chondritic MMs are related to carbonaceous chondrites, the unusually high organic content of UCAMMs points toward a different origin. The formation of the UCAMM organic matter could result from long term irradiation of the surface of icy bodies in the outermost regions of the solar system. Indeed, at such large heliocentric distances, nitrogen and methane rich ices are ubiquitous at their surfaces and their bombardment by non-attenuated galactic cosmic rays may lead to the formation of N-rich carbonaceous material observed in UCAMMs [3].

Results: We recently acquired isotopic images of UCAMM fragments using the ion probe NanoSIMS-50 at Institut Curie (Orsay). In order to gather simultaneous nitrogen and hydrogen isotopic data with the same magnetic field, we developed a protocol to achieve high mass resolution using polyatomic secondary ions [4]. We calibrated the instrumental mass fractionation for hydrogen isotopes using dedicated D-rich organic standards [5]. The UCAMM isotopic images confirm the extreme deuterium excesses and reveal a heterogeneous distribution of the $^{15}N/^{14}N$ ratios showing both ^{15}N-rich and ^{15}N-poor regions. We will present an overview of the latest results obtained on UCAMMs analysed so far (from the 2002 and 2006 CONCORDIA collections).

Acknowledgments: The CONCORDIA station at Dome C, Antarctica, is a joint project of French and Italian polar institute (IPEV and PNRA). This work was supported by ANR contracts COSMISME (ANR-2010-BLAN-0502) and OGRESSE (ANR2011-BS56-026-01) and received support from DIM-ACAV, IN2P3/CNRS, P2IO and CNES.

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